



THE ALMATY METRO DEVELOPMENT PROPOSAL – 2013

RESEARCH PAPER by **Gleb K.Samoilov**

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THE SUMMARY

The Metro is the best form of public transport for cities with the population of over one million people. Developed Subway system is the basis of integration for other modes of transport.

However, the Existing network of the Almaty Metro (including lines under construction and planned lines) does not cover all potential passengers (the Southern part of the City, the Airport area, new residential areas in the North-West).

Prospects for increasing the Almaty city necessitate a significant expansion of the Metro network. The most rational solution is the formation of Ring-Radial scheme (for example, the Concept by G.K.Samoilov, 2013).

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THE INTRODUCTION

Initially Almaty Metro has opened the new stage in the development of public transport in the City. New in the country – off-street public transport – will significantly improve comfort and speed of travel. So, a trip from the station “Raiymbek Batyr” to the station “Alatau” takes 14-16 minutes while the bus or trolley bus trip between same points takes from 25 to 30 minutes at the usual time and 40 to 50 minutes in the morning and evening peak hour.

The ever-increasing passenger traffic on the eight kilometer stretch of the seven stations of the first stage of the underground (“Raiymbek Batyr” – “Zhibek Joly” – “Almaly” – “Abai” – “Baikonur” – “Auezov Teatry” – “Alatau”) allowed to proceed to optimization of the existing route network of ground public transport.

This will make a significant contribution to the implementation of Strategy for Kazakhstan “The transition to “The Green economy”” by the President of the Republic N.A.Nazarbayev [1].

According to published “The Scheme of the Almaty metropolitan” [2], the further development along the Abai avenue metro station “Alatau” (“Sairan” – “Molodejnaia” (or “Moskowskaia”) – “Saryarka” – “Dostyk” – “Kalkaman”) and Seifullin Avenue station “Raiymbek Batyr” (five stations: № 1, 2, 3, 4, 5), a second stage of the “First line”. The “Second Line” subway stations will be twelve stations (№ 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20) connecting the Orbita microdistricts with the Recreation Park. Interchange nodes of these lines will be on the station “Sairan” / № 17 and “Zhibek Zholy” / № 12. Future development of the underground would extend the “First line” of the Railway station “Almaty-1” (three stations: № 6, 7, 8) and the construction of a new line along “the Northern Ring” Street with the interchange on hub station № 16 “Second line” to the station № 8 extended “First line” (eight stations: № 28, 27, 26, 25, 24, 23, 22, 21). In this case the interchange node – station number 8 is integrated with the High-speed Railway station.

In some countries, the optimal distance between Public transports stopping points are regulated, for example, Republic of Kazakhstan Building Rules and Regulations (СНП), Chapter 3.01-01-2008* Urban planning. Layout and development of urban and rural communities; Paragraphs 11.17; 11.18; 11.19:

“11.17 Density of terrestrial transmission network of Public Passenger Transport on the built-up areas needs to be taken depending on the functional use and intensity of passenger flow, usually in the range 1.5-2.5 km/sq.km. In the central districts of Large cities and the largest density of this network is allowed to increase to 4.5 km/sq.km.

11.18 Range pedestrian approaches the nearest public passenger transport should take no more than 500 m, this distance should be reduced in the IV Climatic Subareas to 400 m. In the citywide walking distance of the Center approaches the nearest public passenger transport facilities from mass visits should be no more than 250 m in the Industrial and Communal storage areas – less than 400 meters from the walk-through businesses, in areas of Public recreation and Sport – less than 800 m from the main entrance. In complex terrain, with no special lifting specified distance passenger transport should be reduced by 50 m per 10 m elevation difference Crossing.

Notice. In areas where Individual villa building in the range of pedestrian approaches the nearest bus stop can be increased in Large cities and Major towns up to 600 m, and Small towns and Medium towns – up to 800 m.

11.19 The distances between the stopping points on the lines of public transport within the territory of settlements should be taken: for buses, trolley buses and trams –

400-600 m , express buses and high-speed trams – 800-1200 m , underground – 1000-2000 m, electrified railways – 1500-2000 m” (*the Author’s translation – G.S.*) [3].

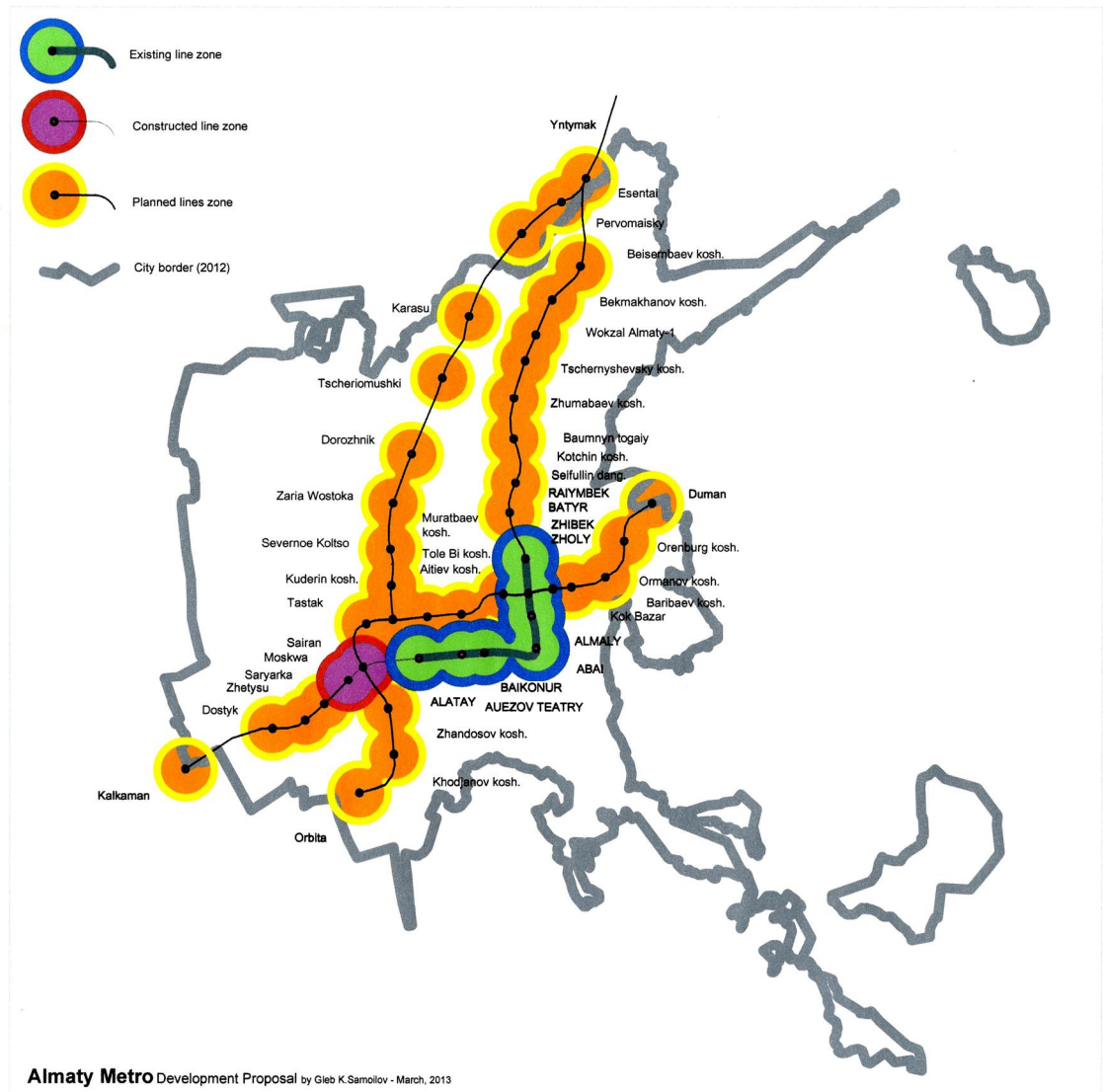
Analogical parameters are specified in operating Design Regulations of the Russian Federation (СНП 2.07.01-89* [4]). In North America they are given as guidelines, which vary from state to state [5; 6]. Average approximate values by different countries are given in Table 1.

Table 1. Walking distances to Public Transport stations in Urban areas (*the Republic of the Kazakhstan; the Russian Federation; the United States of America; the Canada*).

Countries	Bus stops		Express Buses		Metro	
	Crow-fly (m)	Walking (m)	Crow-fly (m)	Walking (m)	Crow-fly (m)	Walking (m)
1	2	3	4	5	6	7
The Republic of the Kazakhstan [3]	200-300	500 (under different conditions -250; -300; -400; -600; -800)	400-600	N/A	500-1000	N/A
The Russian Federation [4]	200-300	500 (under different conditions -250; -300; -400; -600; -800)	400-600	N/A	500-1000	N/A
The United States of America [5; 6]	N/A	400-800	N/A	400-800	N/A	524 (average)
The Canada [5; 6]	N/A	300-900	N/A	300-900	675 (average)	492 (average)

The World practice of Metro systems operation shows that convenient for passengers distance to Metro station – 1.00 km / 0.62 miles. This corresponds to: 15 minutes of Walking; 5 minutes on the Scooter; 4 minutes on the Bicycle; 3 minutes on the Bike; 2 stops by Bus. However, the existing network of the Almaty Metro does not cover all potential passengers even by crow-fly distances (The Figure 1).

THE ZONE OF OPTIMAL ACCESSIBILITY TO ALMATY METRO STATIONS
(radius - 1,0 km / 0,62 mi)
(EXISTING, CONSTRUCTED AND PLANNED LINES)



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov (March, 2013)

Figure 1.
The Zone of optimal accessibility of the Almaty Metro network: Existing, Constructed and Planning lines (1,0 km / 0,62 mi to the station).

Those are next sites as: the Southern part of the City (residential areas, administrative and public facilities, recreation areas), the Airport area, new residential areas in the North-West. Prospects for increasing the Almaty city necessitate a significant expansion of the Subway network. One example of solution to this problem – the formation of Ring-Radial Metro network – it's the Tyne and Wear Metro development proposals by Author – G.K.Samoilov [7, 8].

THE DEVELOPMENT OF THE ALMATY METRO

1. The Determination of the Optimal Metro scheme

The history of the active development of the Underground in Almaty starts at the beginning of the 1980s. Government solutions have defined the procedure for design and construction [9, 10, 11]. During this period, the original scheme of the Subway was adjusted several times [12, 13, 14]. There were also some ideas for further development and improvement [15, 16, 17, 18, 19, 20, 21].

Geographical features of the location of key elements of the external and internal public transportation, residential districts and working areas, places of mass recreation and entertainment, shopping and educational facilities, stadiums and health-sports centers, historical sites and precious natural landscapes of the Almaty determine the acceptable type of Metro scheme. In international practice for similar situations with a polycentric location of objects had successfully applied Ring-Radial schemes.

Further development of a network of Almaty Metro is appropriate to maintain the radial-ring scheme – *names of new stations are relative (from surrounding streets)*. According to this concept developed network of the Almaty Metro is as follows (Figures 2, 3).

The total number of stations 188; the Existing line (7 stations, 5 interchange nodes); the Constructed line (3 stations, 2 interchange nodes); Planned lines (37 stations, 24 interchange nodes); Proposed lines (139 stations, 59 interchange nodes):

- **the Existing Line** (7 stations, 5 interchange nodes): Raiymbek Batyr– Alatay (8 km / 4,97 mi);
- **the Constructed Radial Line – the Continuation of the Existing Line** (3 stations, 2 interchange nodes): Alatay – Moskwa (3 km / 1,86 mi);
- **the Planned Radial Line – the Continuation of the Existing Line** (9 stations, 6 interchange nodes): Raiymbek Batyr – Yntymak (20 km / 12,43 mi);
- **the Planned Radial Line – the Continuation of the Constructed Line** (4 stations, 1 interchange node): Moskwa – Kalkaman (8 km / 4,97 mi);
- **the Planned Radial Line** (15 stations, 10 interchange node): Orbita – Duman (24 km / 14,91 mi);
- **the Planned Line** (9 stations, 7 interchange node): Tole Bi koshesi – Yntymak (22 km / 13,67 mi);
- **the Proposed Ring RED Line** (26 stations, 18 interchange nodes): *Almaty-Auezhai – Koktobe – Taugul' – Shanyrak – Wokzal Almaty-1* (68 km / 42,25 mi);
- **the Proposed Radial BLUE Line** (18 stations, 10 interchange nodes): Suranshy Batyr koshesi – Ibragimov koshesi (48 km / 29,83 mi);
- **the Proposed Radial GREEN Line** (24 stations, 12 interchange nodes): Kyrgauldy – Otegen Batyr (50 km / 31,07 mi);
- **the Proposed Radial ORANGE Line** (19 stations, 9 interchange nodes): Almalybak – Kyzylkairat (46 km / 28,58 mi);

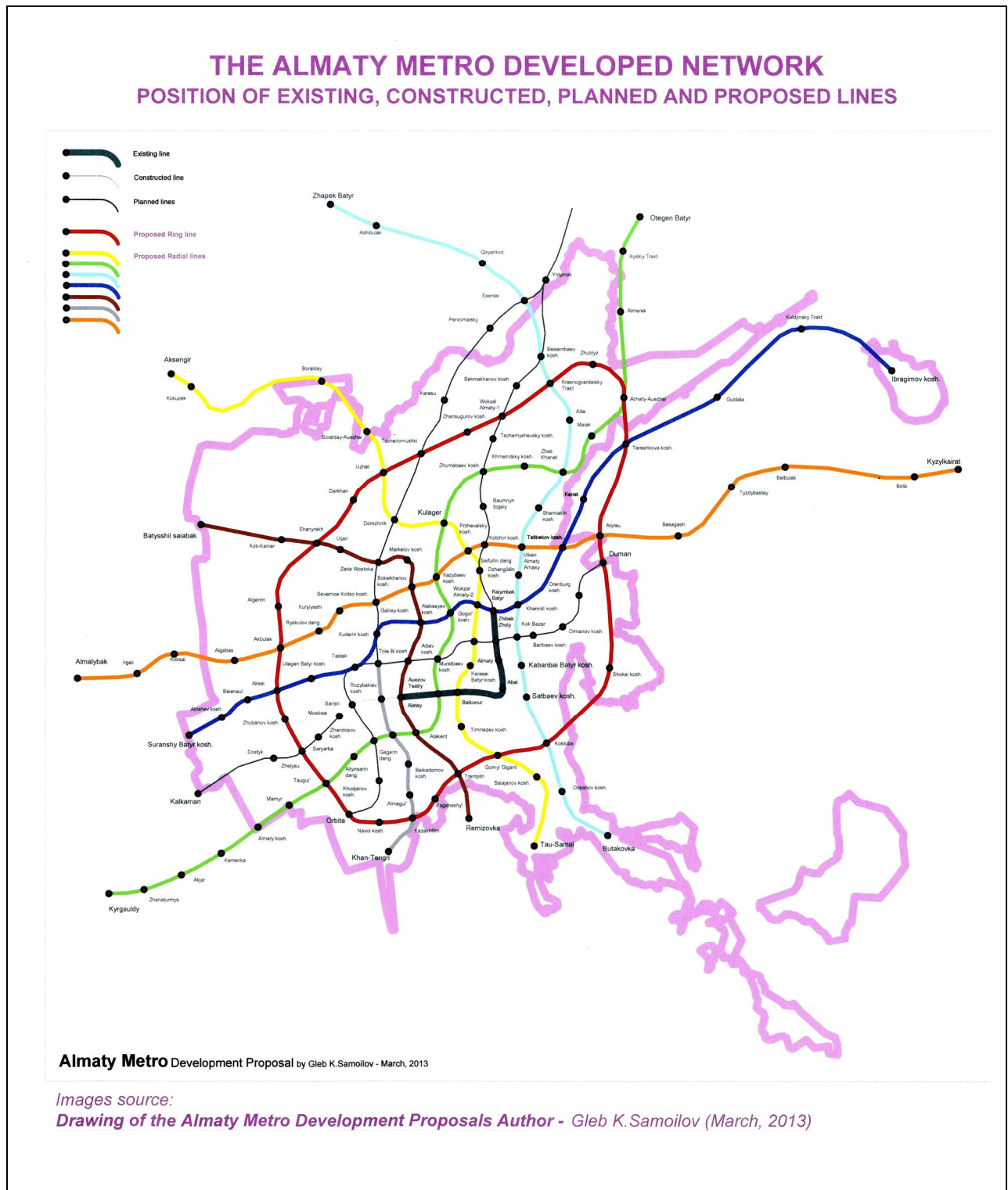
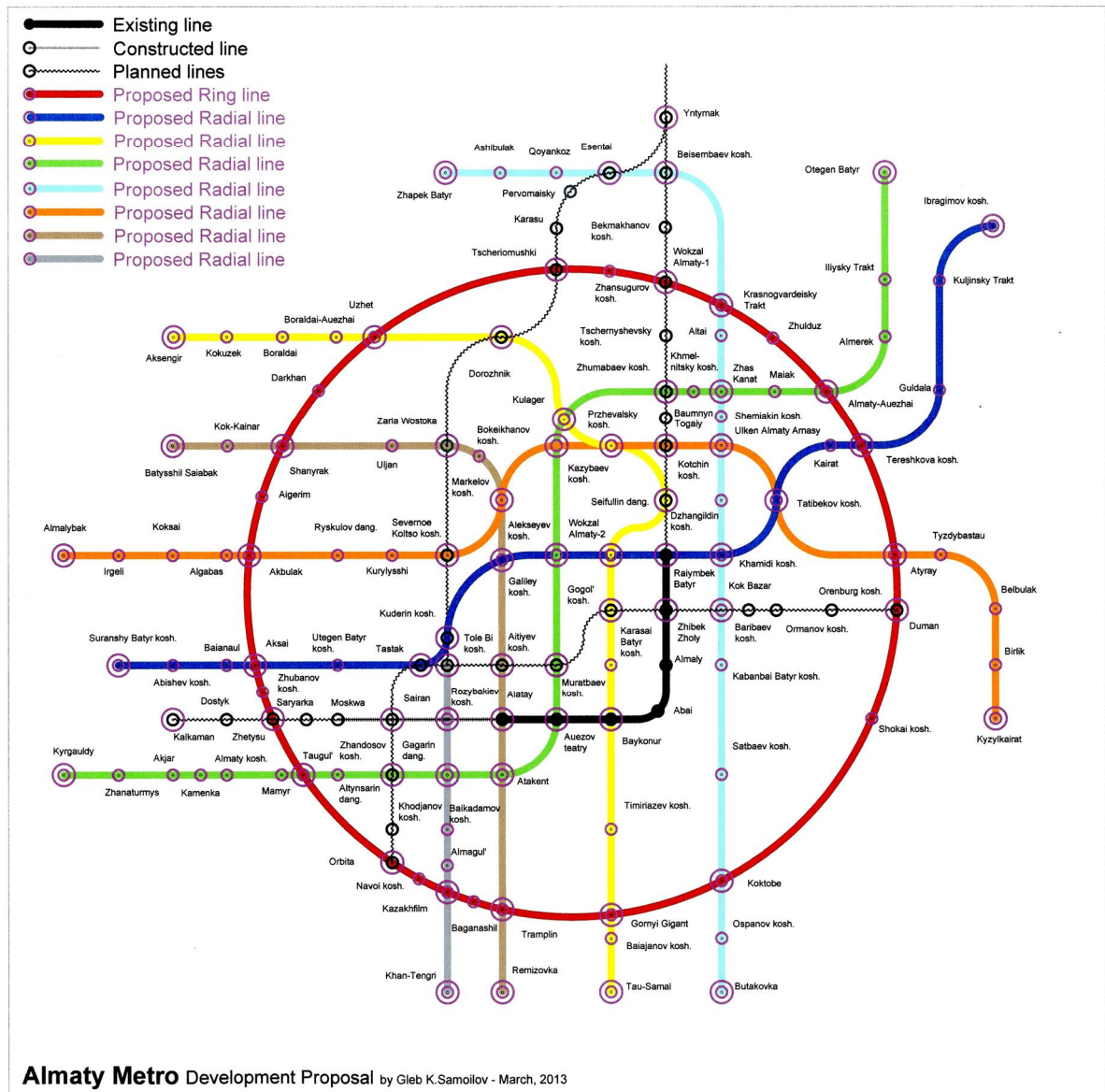


Figure 2.
The Conception of the Almaty Metro Development (the Map).

THE ALMATY METRO DEVELOPED NETWORK

EXISTING, CONSTRUCTED, PLANNED LINES & PROPOSED RING AND RADIAL LINES



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K. Samoilov "Gleconsam" (March, 2013)

Figure 3.
The Conception of the Almaty Metro Development (the Scheme).

- **the Proposed Radial BROWN Line** (13 stations, 8 interchange nodes): Batysshil Saiabak – Remizovka (26 km / 16,16 mi);
- **the Proposed Radial YELLOW Line** (17 stations, 9 interchange nodes): Aksengir – Tau-Samal (37 km / 22,99 mi);
- **the Proposed Radial CELADON Lane** (18 stations, 8 interchange nodes): Zhapek Batyr – Butakovka (40 km / 24,85 mi);
- **the Proposed Radial GREY Line** (7 stations, 4 interchange nodes): Tole Bi koshesi – Khan-Tengri (10 km / 6,21 mi).

Endpoints of all the proposed Metro lines (with the exception of the “Grey”) linked to a lane of the Big Almaty Ring Road – “БАКАД” [22].

2. Lines of the Ring-Radial Metro scheme

Position of existing, constructed and planned lines in the proposed Radial-Ring network (Figure 4). The existing, constructed and planned radial lines in the diagram shown in Black. The stations of these lines provide interchanges to the proposed Ring line and Radial lines (Red, Blue, Green, Yellow, Orange, Brown, Grey and Celadon). **THE EXISTING LINE** (7 stations, 5 interchange nodes): Raiymbek Batyr (*the Interchange node with the Planned Radial Line and with the Proposed Radial BLUE Line*) – Zhibek Zholy (*the Interchange node with the Planned Radial Line*) – Almaly – Abai – Baykonur (*the Interchange node with the Proposed Radial YELLOW Line*) – Auezov teatry (*the Interchange node with the Proposed Radial GREEN Line*) – Alatay (*the Interchange node with the Constructed Line and with the Proposed Radial BROWN Line*). **THE CONSTRUCTED RADIAL LINE – the Continuation of the Existing Line** (3 stations, 2 interchange nodes): Alatay (*the Station of the Existing Line, the Interchange node with the Proposed Radial BROWN Line*) – Rozybakiev koshesi (*the NEW PROPOSED STATION, the Interchange node with the Proposed Radial GREY Line*) – Sairan (*the Interchange node with the Planned Radial Line*) – Moskwa (*the Interchange node with the Planned Radial Line*). **THE PLANNED RADIAL LINE – the Continuation of the Existing Line** (9 stations, 6 interchange nodes): Raiymbek Batyr (*the Station of the Existing Line, the Interchange node with the Proposed Radial BLUE Line*) – Dzhangildin koshesi (*the Interchange node with the Proposed Radial YELLOW Line*) – Kotchin koshesi (*the Interchange node with the Proposed Radial ORANGE Line*) – Baumnyyn Togaiy – Zhumabaev koshesi (*the Interchange node with the Proposed Radial GREEN Line*) – Tschernyshevsky koshesi – Wokzal Almaty-1 (*the Interchange node with the Proposed Ring RED Line*) – Bekmakhanov koshesi – Beisembaev koshesi (*the Interchange node with the Proposed Radial CELADON Line*) – Yntymak (*the Interchange node with the Planned Radial Line*). **THE PLANNED RADIAL LINE – the Continuation of the Constructed Line** (4 stations, 1 interchange node): Moskwa (*the Station of the Constructed Line*) – Saryarka – Zhetysu (*the Interchange node with the Proposed Ring RED Line*) – Dostyk – Kalkaman. **THE PLANNED RADIAL LINE** (15 stations, 10 interchange node): Orbita (*the Interchange node with the Proposed Ring RED Line*) – Khodjanov koshesi – Zhandosov koshesi (*the Interchange node with the Proposed Radial GREEN Line*) – Sairan (*the Interchange node with the Constructed Radial Line*) – Tastak (*the Interchange node with the Proposed Radial BLUE Line*) – Tole Bi koshesi (*the Interchange node with the Planned Line / the Proposed Radial GREY Line*) – Aitiyev koshesi (*the Interchange node with the Proposed Radial BROWN Line*) – Muratbaev koshesi (*the Interchange node with the Proposed Radial GREEN Line*) – Gogol’ koshesi (*the Interchange node with the Proposed Radial YELLOW Line*) – Zhibek Zholy (*the Interchange node with the Existing Line*) – Kok Bazar (*the*

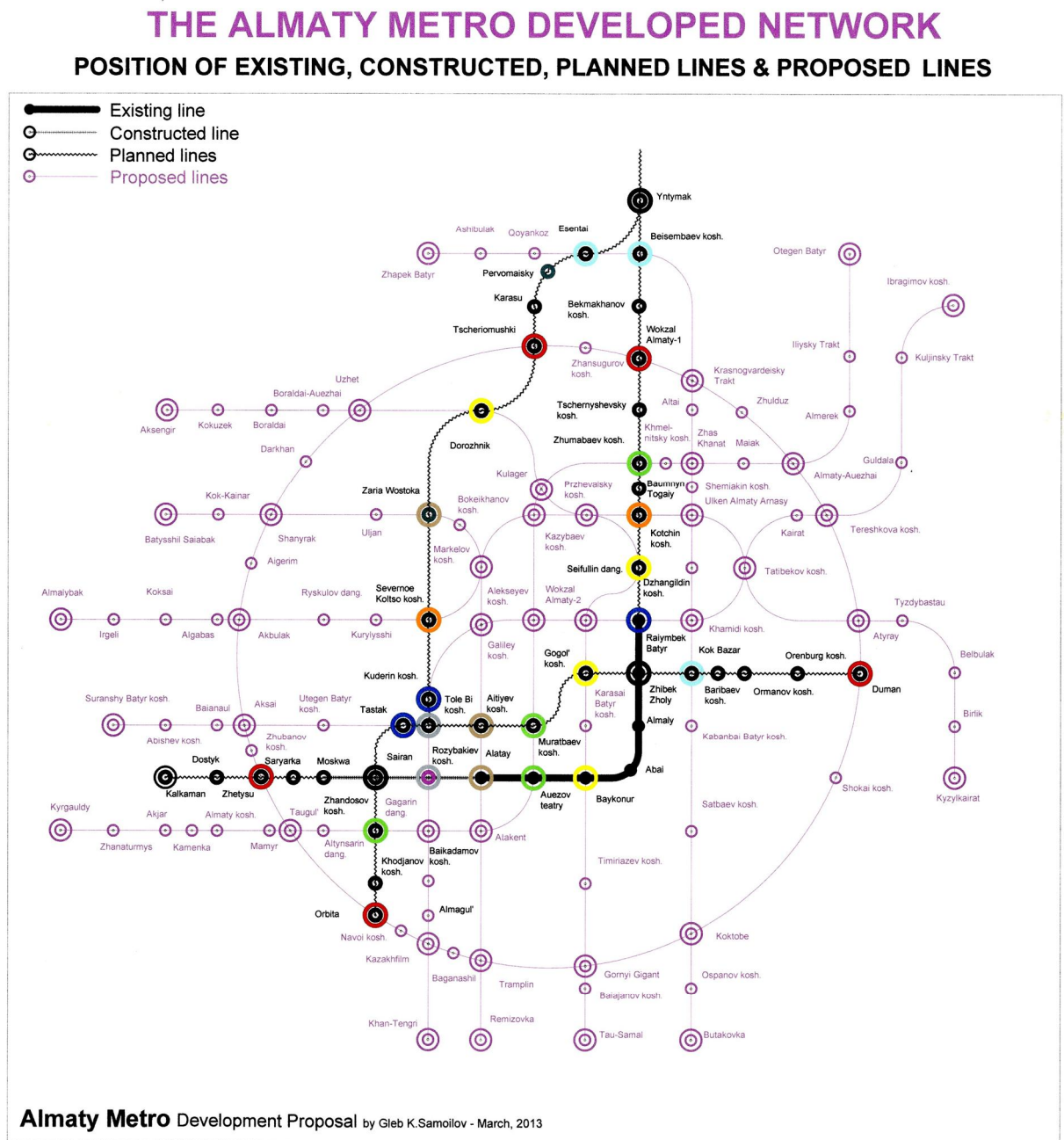
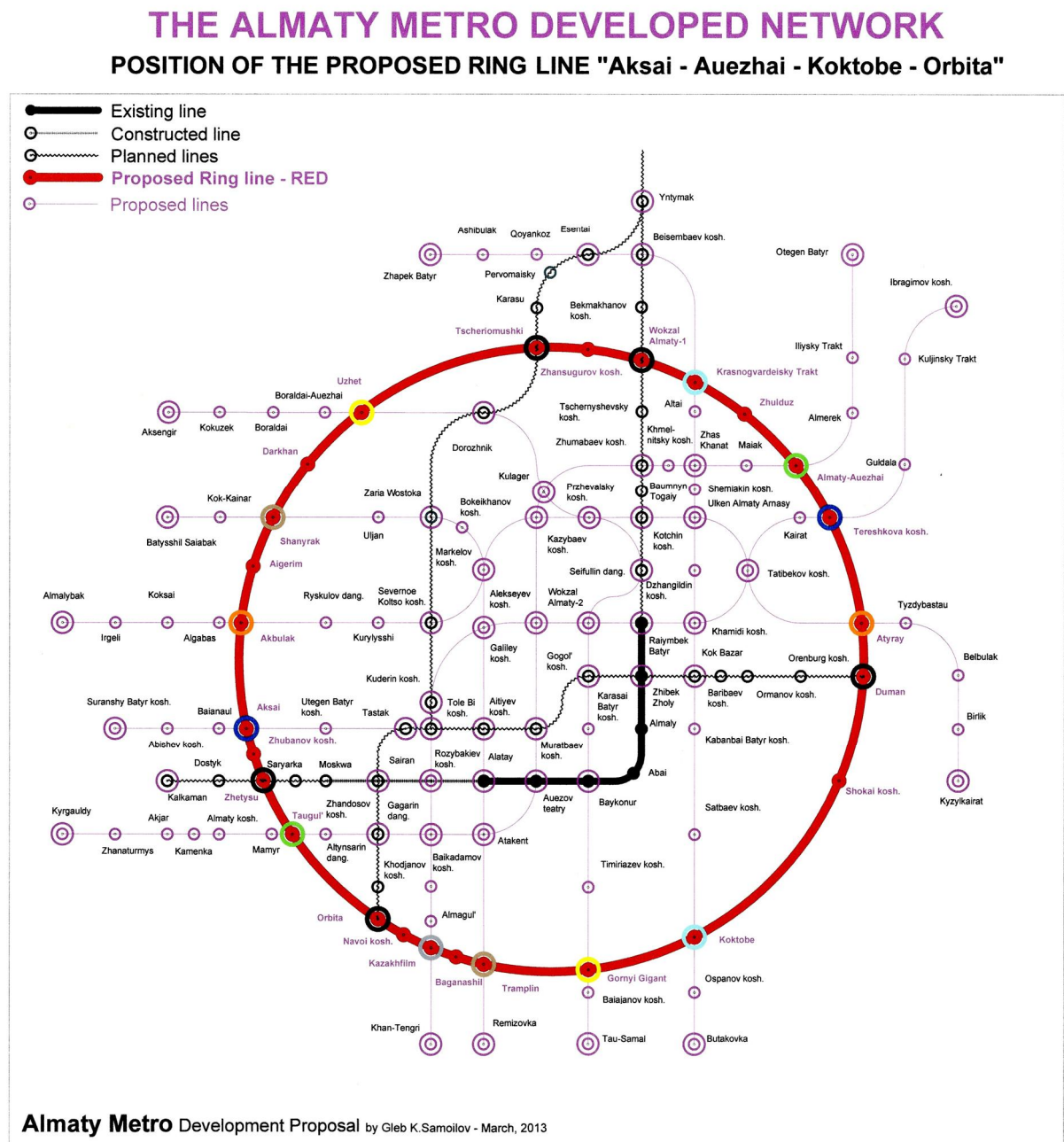


Figure 4.
The Almaty Metro developed network (position of existing, constructed and planned lines).

*Interchange node with the Proposed Radial CELADON Line) – Baribaev koshesi – Ormanov koshesi – Orenburg koshesi – Duman (the Interchange node with the Proposed Ring RED Line). **THE PLANNED LINE** (9 stations, 7 interchange node): Tole Bi koshesi (the Interchange node with the Planned Radial Line) – Kuderin koshesi (the Interchange node with the Proposed Radial BLUE Line) – Severnoe Koltso koshesi (the Interchange node with the Proposed Radial ORANGE Line) – Zaria Wostoka (the Interchange node with the Proposed Radial BROWN Line) – Dorozhnik (the Interchange node with the Proposed Radial YELLOW Line) – Tscheriomushki (the Interchange node with the Proposed Ring RED Line) – Karasu – Pervomaisky – Esentai (the Interchange node with the Proposed Radial CELADON Line) – Yntymak (the Interchange node with the Planned Radial Line).*

The proposed Ring line in the diagram shown in Red (Figure 5). The stations of this line provide interchanges to all the radial lines (planned and proposed: Yellow, Blue, Green, Orange, Brown, Grey, Celadon). **THE PROPOSED RING RED LINE** (26 stations, 18 interchange nodes): *Almaty-Auezhai (the Interchange node with the Proposed Radial GREEN Line) – Tereshkova koshesi (the Interchange node with the Proposed Radial BLUE Line) – Atyray (the Interchange node with the Proposed Radial ORANGE Line) – Duman (the Interchange node with the Planned Radial Line) – Shokai koshesi – Koktobe (the Interchange node with the Proposed Radial CELADON Line) – Gornyi Gigant (the Interchange node with the Proposed Radial YELLOW Line) – Tramplin (the Interchange node with the Proposed Radial BROWN Line) – Baganashil – Kazakhfilm (the Interchange node with the Proposed Radial GREY Line) – Navoi koshesi – Orbita (the Interchange node with the Planned Radial line) – Taugul' (the Interchange node with the Proposed Radial GREEN Line) – Saryarka (the Interchange node with the Planned Radial Line) – Zhubanov koshesi – Aksai (the Interchange node with the Proposed Radial BLUE Line) – Akbulak (the Interchange node with the Proposed Radial ORANGE Line) – Aigerim – Shanyrak (the Interchange node with the Proposed Radial BROWN Line) – Darkhan – Uzhet (the Interchange node with the Proposed Radial YELLOW Line) – Tscheriomushki (the Interchange node with the Planned Radial Line) – Zhansugurov koshesi – Wokzal Almaty-1 (the Interchange node with the Planned Radial Line) – Krasnogvardeisky Trakt (the Interchange node with the Proposed Radial CELADON Line) – Zhulduz*.

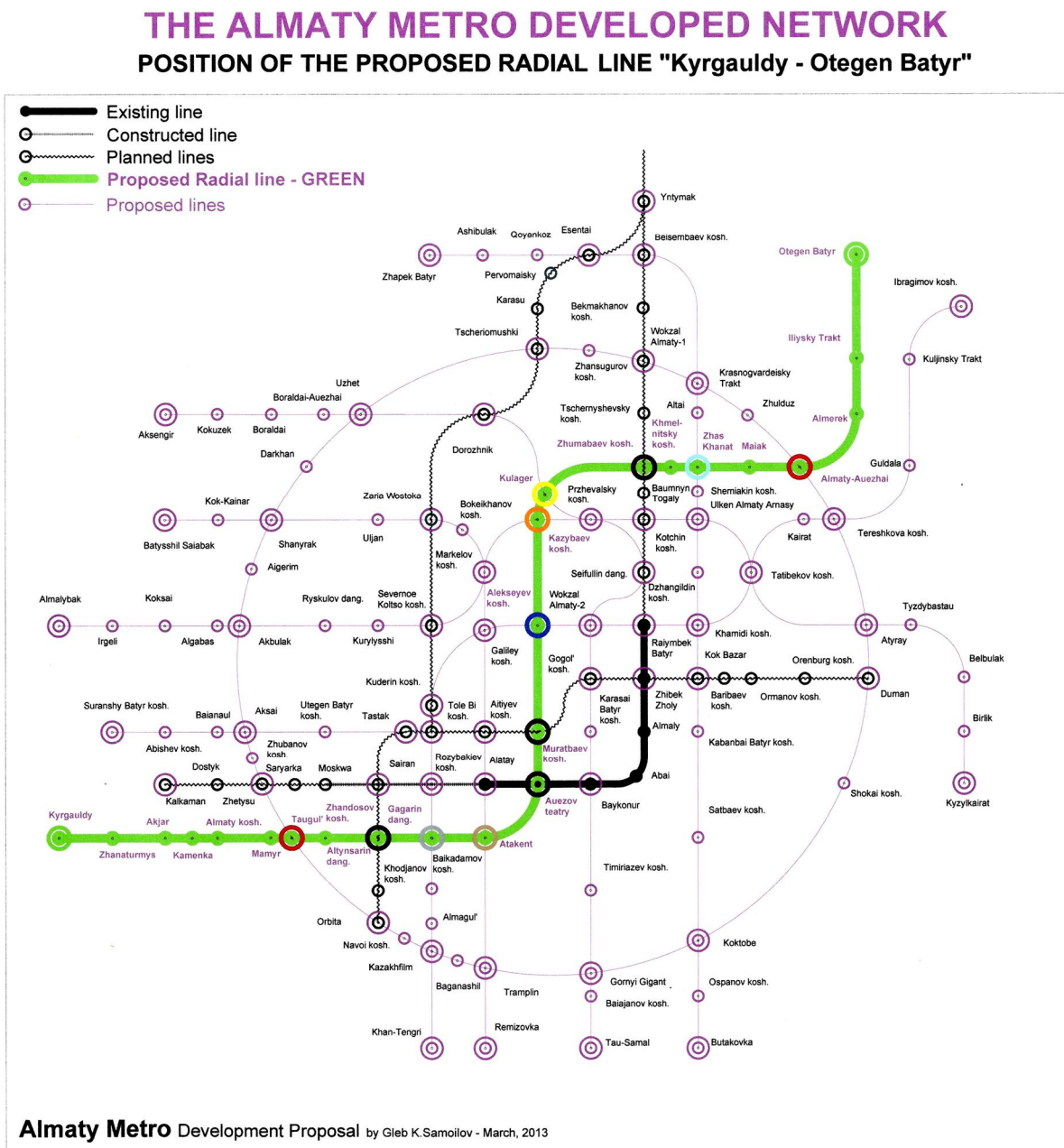
The proposed Radial line in the diagram shown in Green (Figure 6). The stations of this line provide interchanges to the ring line and radial lines (existing, planned and proposed: Red, Blue, Yellow, Orange, Brown, Grey and Celadon). **THE PROPOSED RADIAL GREEN LINE** (24 stations, 12 interchange nodes): Kyrgauldy – Zhanaturmys – Akjar – Kamenka – Almaty koshesi – Mamyr – Taugul' (the Interchange node with the Proposed Ring RED Line) – Altynsarin dangyly – Zhandosov koshesi (the Interchange node with the Planned Radial Line) – Gagarin dangyly (the Interchange node with the Proposed Radial GREY Line) – Atakent (the Interchange node with the Proposed Radial BROWN Line) – Auezov Teatry (the Interchange node with the Existing Line) – Muratbaev koshesi (the Interchange node with the Planned Radial Line) – Alekseev koshesi (the Interchange node with the Proposed Radial BLUE Line) – Kazybaev koshesi (the Interchange node with the Proposed Radial ORANGE Line) – Kulager (the Interchange node with the Proposed Radial YELLOW Line) – Zhumabaev koshesi (the Interchange node with the Planned Radial Line) – Khmelknitsky koshesi – Zhas Kanat (the Interchange node with the Proposed Radial CELADON Line) – Maiak – Almaty Auezhai (the Interchange node with the Proposed Ring RED Line) – Almerék – Iliysky Trakt – Otegen Batyr.



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov "Gleconsam" (March, 2013)

Figure 5.
The Almaty Metro developed network – the proposed Ring Line “Aksai – Auezhai – Koktobe - Orbita”



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov "Gleconsam" (March, 2013)

Figure 6.
The Almaty Metro developed network – the proposed Radial Line “Kyrgauldy – Otegen Batyr”.

The proposed Radial line in the diagram shown in Blue (Figure 7). The stations of this line provide interchanges to the ring line and radial lines (existing, planned and proposed: Red, Yellow, Green, Orange, Brown and Celadon). **THE PROPOSED RADIAL BLUE LINE** (18 stations, 10 interchange nodes): Suranshy Batyr koshesi – Abishev koshesi – Baianaul – Aksai (*the Interchange node with the Proposed Ring RED Line*) – Utegen Batyr koshesi – Tastak (*the Interchange node with the Planned Radial Line*) – Kuderin koshesi (*the Interchange node with the Planned Radial Line*) – Galiley koshesi (*the Interchange node with the Proposed Radial BROWN Line*) – Alekseyev koshesi (*the Interchange node with the Proposed Radial GREEN Line*) – Wokzal Almaty-2 (*the Interchange node with the Proposed Radial YELLOW Line*) – Raiymbek Batyr (*the Interchange node with the Existing Line / Planned Radial Line*) – Khamidi koshesi (*the Interchange node with the Proposed Radial CELADON Line*) – Tatibekov koshesi (*the Interchange node with the Proposed Radial ORANGE Line*) – Kairat – Tereshkova koshesi (*the Interchange node with the Proposed Ring RED Line*) – Guldala – Kuljinsky Trakt – Ibragimov koshesi.

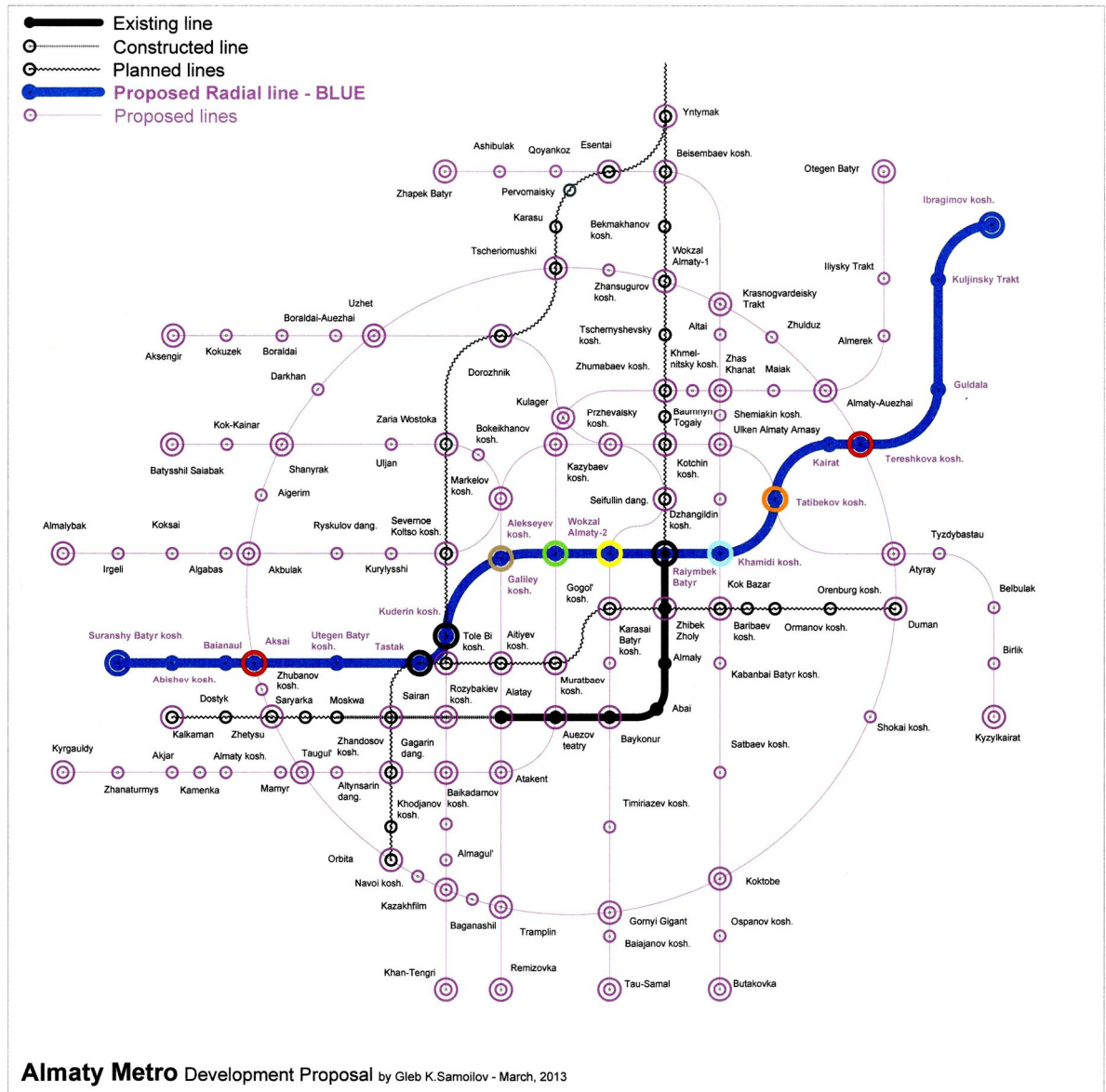
The proposed Radial line in the diagram shown in Orange (Figure 8). The stations of this line provide interchanges to the ring line and radial lines (planned and proposed: Red, Blue, Green, Yellow, Brown and Celadon). **THE PROPOSED RADIAL ORANGE LINE** (19 stations, 9 interchange nodes): Almalybak – Irgeli – Koksai – Algabas – Akbulak (*the Interchange node with the Proposed Ring RED Line*) – Ryskulov danglyly – Kurylysshi – Severnoe Koltso koshesi (*the Interchange node with the Planned Radial Line*) – Bokeikhanov koshesi (*the Interchange node with the Proposed Radial BROWN Line*) – Kazybaev koshesi (*the Interchange node with the Proposed Radial GREEN Line*) – Przhevalsky koshesi (*the Interchange node with the Proposed Radial YELLOW Line*) – Kotchin koshesi (*the Interchange node with the Planned Radial Line*) – Ulken Almaty Arnasy (*the Interchange node with the Proposed Radial CELADON Line*) – Tatibekov koshesi (*the Interchange node with the Proposed Radial BLUE Line*) – Atyray (*the Interchange node with the Proposed Ring RED Line*) – Tyzdybastau – Belbulak – Birlik – Kyzylkairat.

The proposed Radial line in the diagram shown in Brown (Figure 9). The stations of this line provide interchanges to the ring line and radial lines (existing, planned and proposed: Red, Blue, Green, Orange). **THE PROPOSED RADIAL BROWN LINE** (13 stations, 8 interchange nodes): Batysshil Saiabak – Kok-Kainar – Shanyrak (*the Interchange node with the Proposed Ring RED Line*) – Uljan – Zaria Wostoka (*the Interchange node with the Planned Radial Line*) – Markelov koshesi – Bokeikhanov koshesi (*the Interchange node with the Proposed Radial ORANGE Line*) – Galiley koshesi (*the Interchange node with the Proposed Radial BLUE Line*) – Aitiyev koshesi (*the Interchange node with the Planned Radial Line*) – Alatay (*the Interchange node with the Existing Line*) – Atakent (*the Interchange node with the Proposed Radial GREEN Line*) – Trampolin (*the Interchange node with the Proposed Ring RED Line*) – Remizovka.

The proposed Radial line in the diagram shown in Yellow (Figure 10). The stations of this line provide interchanges to the ring line and radial lines (existing, planned and proposed: Red, Blue, Green and Orange). **THE PROPOSED RADIAL YELLOW LINE** (17 stations, 9 interchange nodes): Aksengir – Kokuzek – Boraldai – Boraldai-Auezhai – Uzhet (*the Interchange node with the Proposed Ring RED Line*) – Dorozhnik (*the Interchange node with the Planned Radial Line*) – Kulager (*the Interchange node with the Proposed Radial GREEN Line*) – Przhevalsky koshesi (*the Interchange node with the Proposed Radial ORANGE Line*) – Seifullin danglyly (*the Interchange node with the Planned Radial Line*) – Wokzal Almaty-2 (*the Interchange node with the Proposed Radial BLUE Line*) – Gogol' koshesi (*the Interchange node with*

THE ALMATY METRO DEVELOPED NETWORK

POSITION OF THE PROPOSED RADIAL LINE "Suranshy Batyr koshesi - Ibragimov koshesi"



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov "Gleconsam"(March, 2013)

Figure 7.
The Almaty Metro developed network – the proposed Radial Line “Suranshy Batyr koshesi – Ibragimov koshesi”.

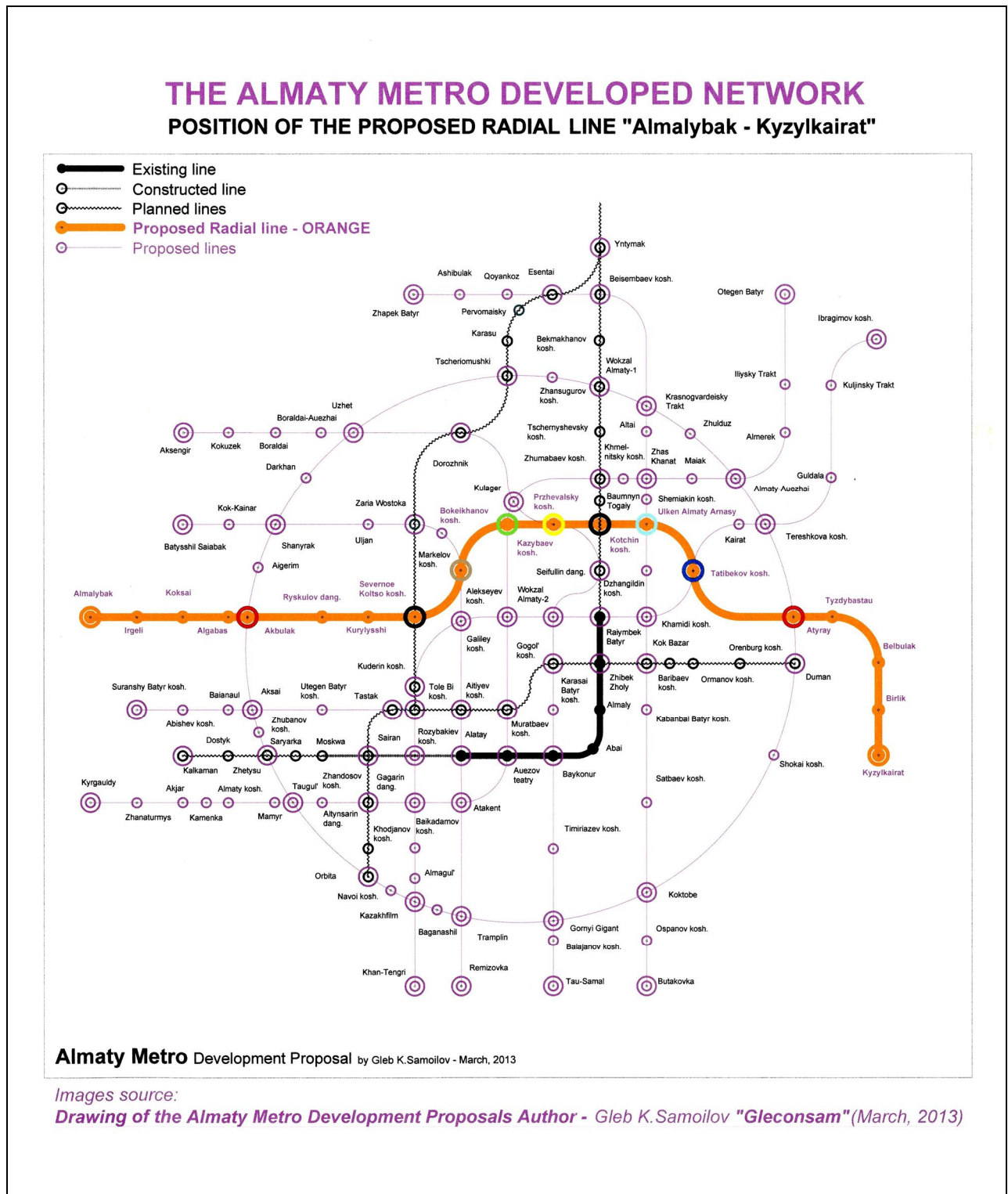
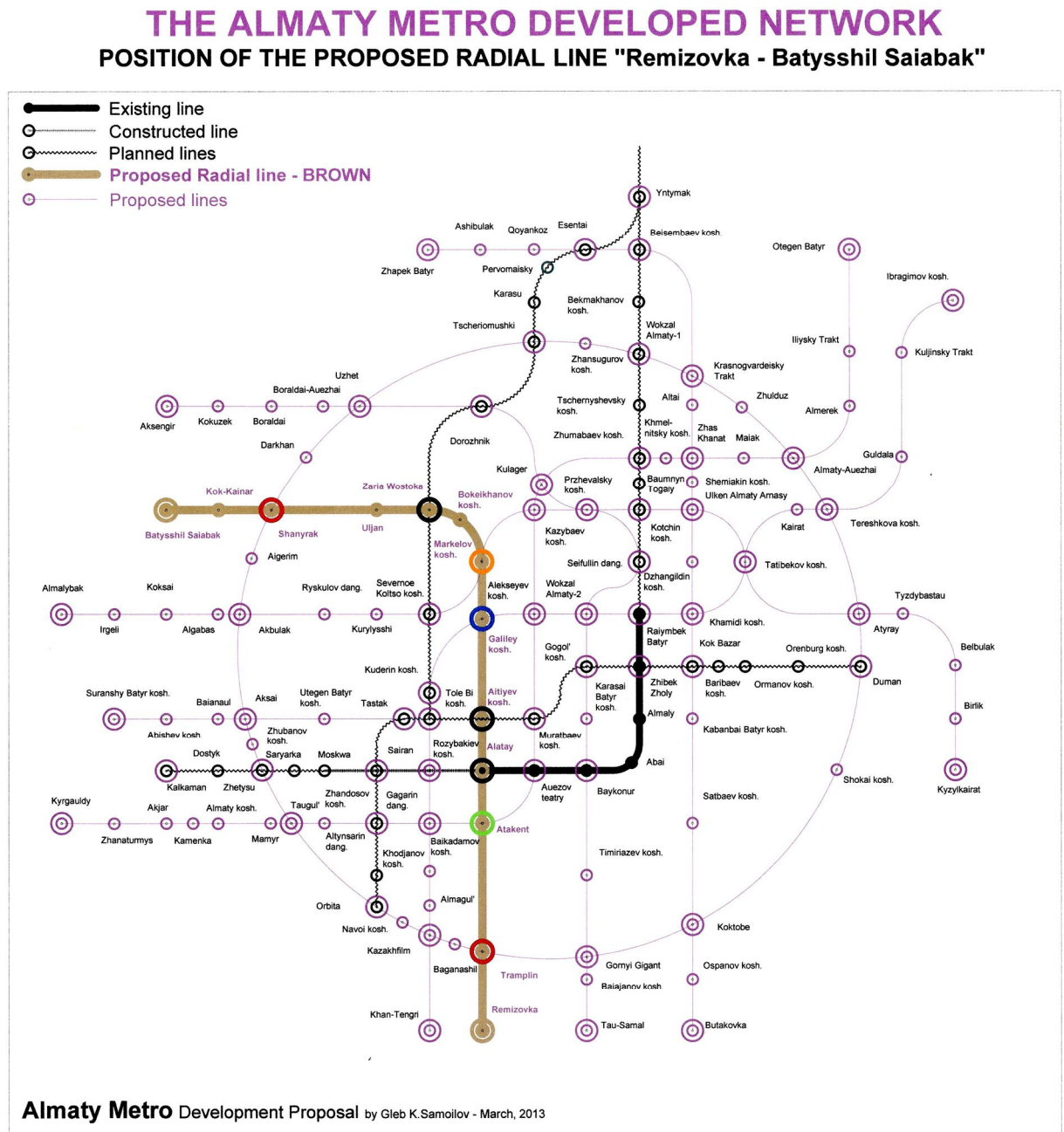


Figure 8.
The Almaty Metro developed network – the proposed Radial Line “Almalybak - Kyzylkairat”.



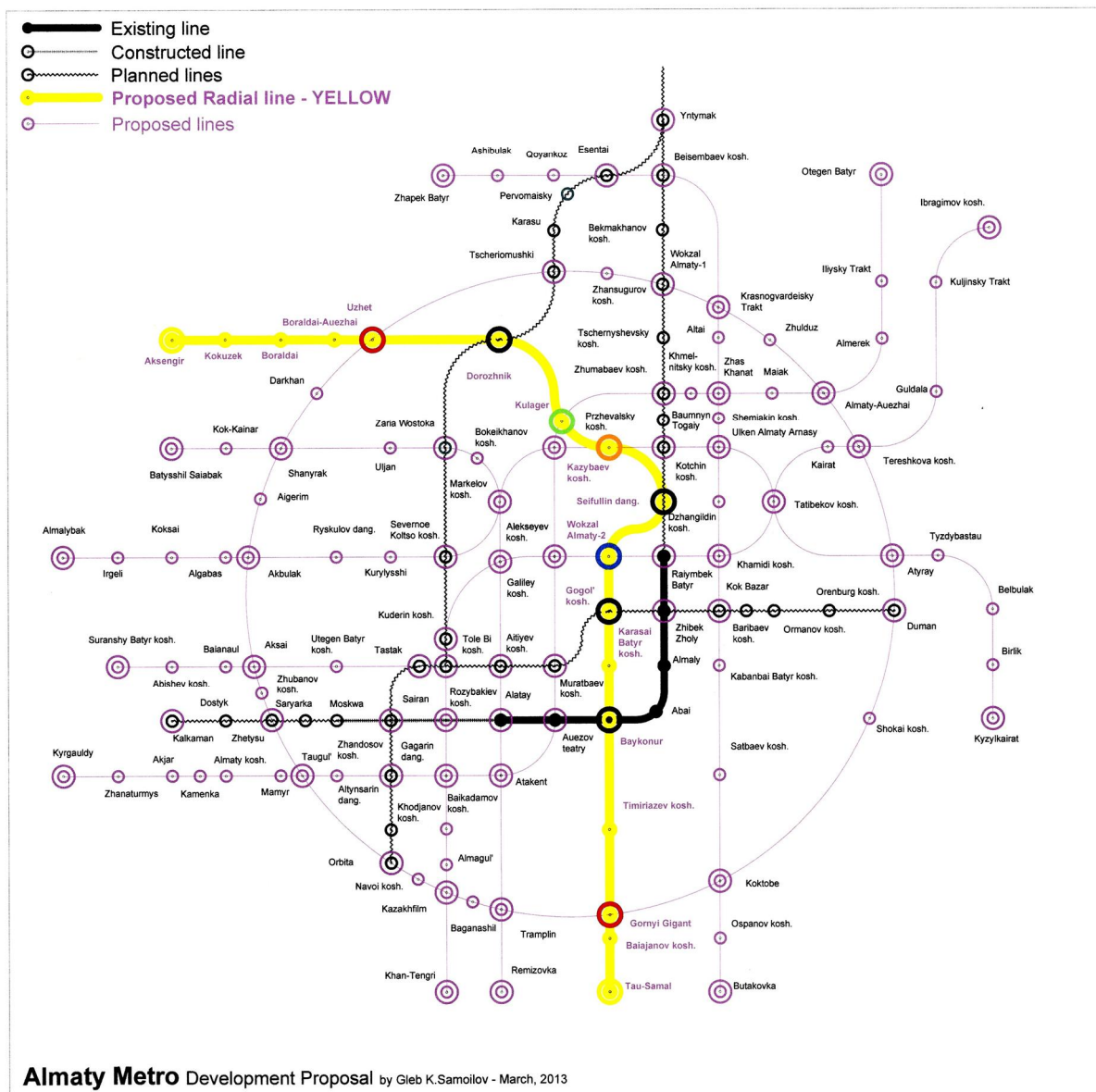
Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov "Gleconsam"(March, 2013)

Figure 9.
The Almaty Metro developed network – the proposed Radial Line “Remizovka – Batysshil Saiabak”.

THE ALMATY METRO DEVELOPED NETWORK

POSITION OF THE PROPOSED RADIAL LINE "Aksengir - Tau-Samal"

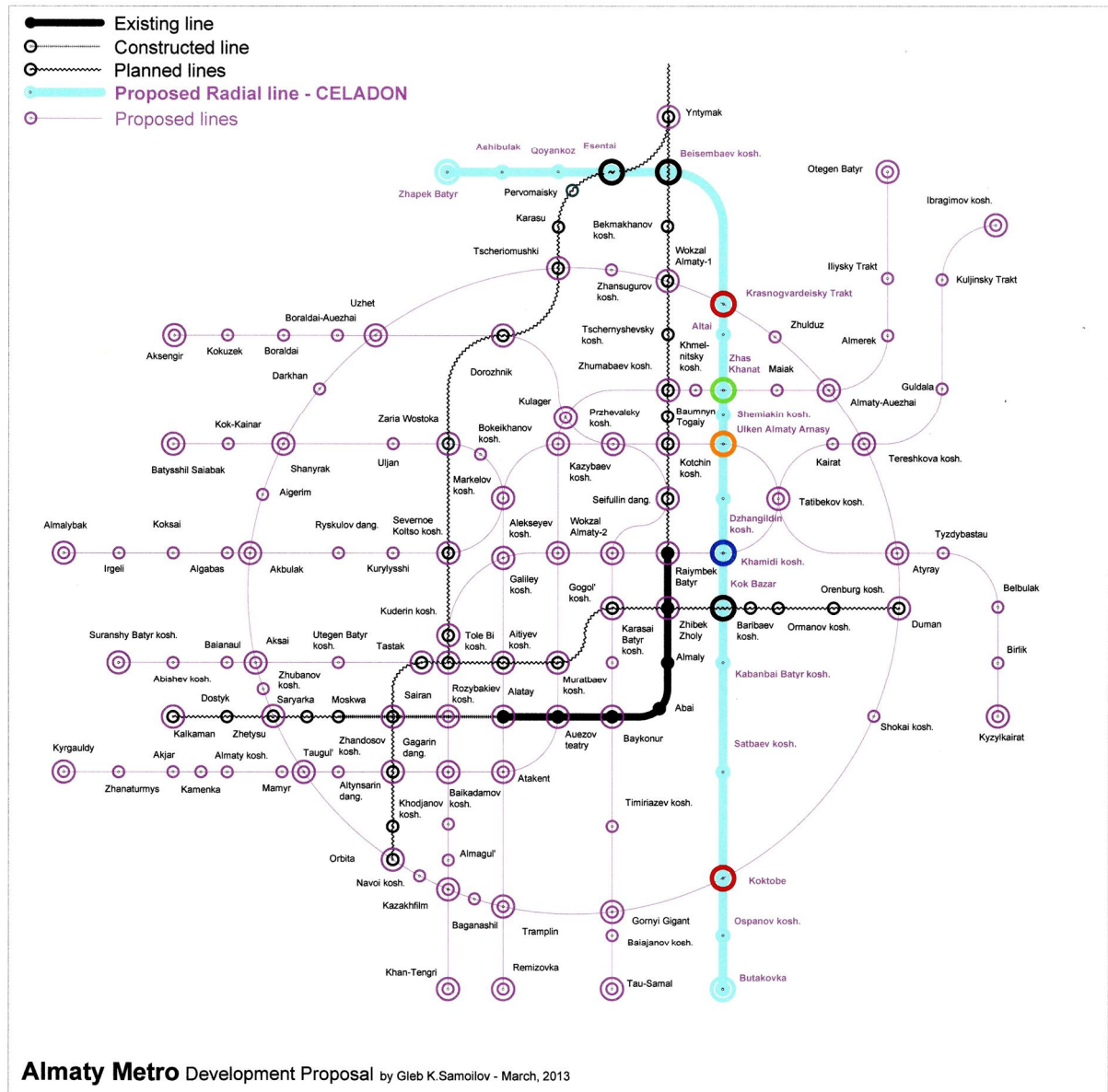


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Figure 10.
The Almaty Metro developed network – the proposed Radial Line “Aksengir – Tau-Samal”.

THE ALMATY METRO DEVELOPED NETWORK



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov "Gleconsam" (March, 2013)

Figure 11.
The Almaty Metro developed network – the proposed Radial Line “Butakovka – Zhapek Batyr”.

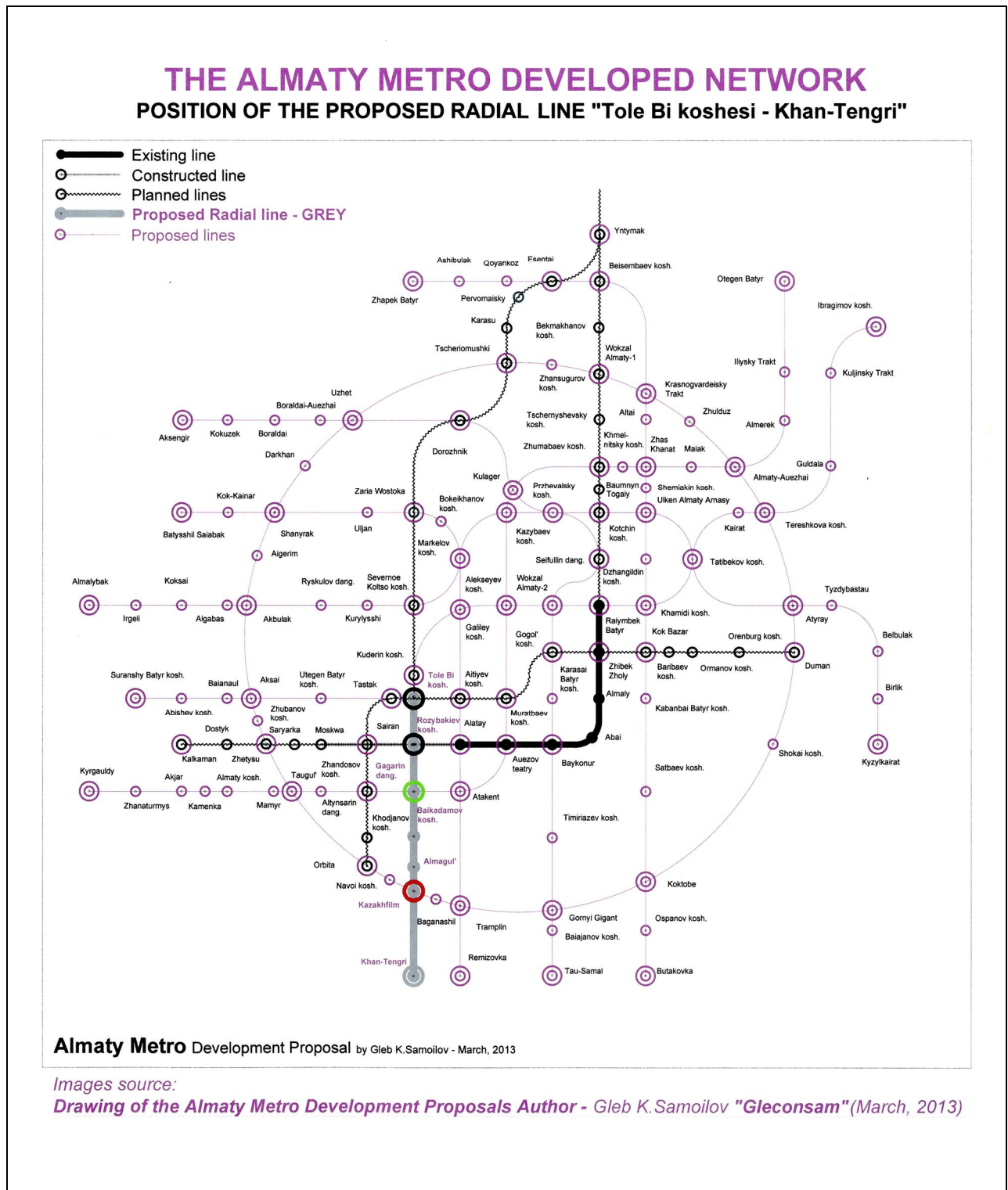


Figure 12.
The Almaty Metro developed network – the proposed Radial Line “Tole Bi koshesi – Khan-Tengri”.

the Planned Radial Line) – Karasai Batyr koshesi – Baykonur *(the Interchange node with the Existing Line)* – Timiriazhev koshesi – Gorny Gigant *(the Interchange node with the Proposed Ring RED Line)* – Baiajanov koshesi – Tau-Samal.

The proposed Radial line in the diagram shown in Celadon (Figure 11). The stations of this line provide interchanges to the ring line and radial lines (planned and proposed: Red, Blue, Green, Orange). **THE PROPOSED RADIAL CELADON LANE** (18 stations, 8 interchange nodes): Zhapek Batyr – Ashibulak – Qoyankoz – Esentai *(the Interchange node with the Planned Radial Line)* – Beisembaev koshesi *(the Interchange node with the Planned Radial Line)* – Krasnogvardeisky Trakt *(the Interchange node with the Proposed Ring RED Line)* – Altai – Zhas Kanat *(the Interchange node with the Proposed Radial GREEN Line)* – Shemiakin koshesi – Ulken Almaty Arnasy *(the Interchange node with the Proposed Radial ORANGE Line)* – Dzhangildin koshesi – Khamidi koshesi *(the Interchange node with the Proposed Radial BLUE Line)* – Kok Bazar *(the Interchange node with the Planned Radial Line)* – Kabanbai Batyr koshesi – Satbaev koshesi – Koktobe *(the Interchange node with the Proposed Ring RED Line)* – Ospanov koshesi – Butakovka.

The proposed Radial line in the diagram shown in Grey (Figure 12). The stations of this line provide interchanges to the ring line and radial lines (constructed, planned and proposed: Red, Green). **THE PROPOSED RADIAL GREY LINE** (7 stations, 4 interchange nodes): Tole Bi koshesi *(the Interchange node with the Planned Radial Line)* – Rozybakiev koshesi *(the Interchange node with the Constructed Line)* – Gagarin danglyly *(the Interchange node with the Proposed Radial GREEN Line)* – Baikadamov koshesi – Almagul' – Kazakhfilm *(the Interchange node with the Proposed Ring RED Line)* – Khan-Tengri.

3. The Formation of the Ring-Radial Metro scheme

In proposed extensive Metro scheme the interchanges of two kinds are applied – “Parallel” and “Perpendicular”. All the new stations have “Island” platform type. Reconstructed stations have platforms of “Island” type and “Coastal” type.

“Perpendicular” interchange node provides the passenger transition from station to station in three versions: “Side-Side”, “Middle-Side” or “Side-Middle”, “Middle-Middle”.

“Parallel” interchange node provides the transfer on the station in two ways: “On the same platform” with the transfer of passengers in the forward direction, or “Over the platform” for transfer of passengers in the opposite direction.

To ensure reliable operation of underground lines between stations located detour sections and deadlock sections.

The length of detour sections allows overtaking, parking and change of direction. In the scheme three types of detour are used.

- Detour-1: the detour to the left of main tracks, the detour between of main tracks, the detour to the right of main tracks. The Detour-1 provides the ability to maneuver for five trains.

- Detour-2: the detour to the left of main tracks or the detour to the right of main tracks, the detour between of main tracks. The Detour-2 provides the ability to maneuver for four trains.

- Detour-3: the detour between of main tracks. The Detour-3 provides the ability to maneuver for three trains.

The length of deadlock sections allows parking and change of direction. Used three types of deadlock.

- Deadlock-1: the deadlock to the left of main tracks, the deadlock between of main tracks, the deadlock to the right of main tracks, ends of main tracks. The Deadlock-1 provides the ability to maneuver for five trains.

- Deadlock-2: the deadlock to the left of main tracks or the deadlock to the right of main tracks, the deadlock between of main tracks, ends of main tracks. The Deadlock-2 provides the ability to maneuver for four trains.

- Deadlock-3: the deadlock between main tracks ends of main tracks. The Deadlock-3 provides the ability to maneuver for three trains.

All new stations lobbies for inputs and outputs from streets (antechambers or anterooms) are located below ground.

Design features of subways in the Republic of Kazakhstan assessed by the relevant Chapter of Building Rules and Regulations [23].

The development consists of five successive stages.

The First Stage of the Development.

The First Stage of the Ring-Radial scheme development (Figure 13) - the Ring lane construction (26 new stations, 18 new interchange nodes).

Lines under construction for this Development Stage (the Ring Lane):

ALMATY-AUEZHAI (the New station; the New Interchange node with the Proposed Radial Lane) – TERESHKOVA KOSHESI (the New station; the New Interchange node with the Proposed Radial Lane) – ATYRAY (the New station; the New Interchange node with the Proposed Radial Lane) – DUMAN (the New station; the New Interchange node with the Planned Radial Lane) – SHOKAI KOSHESI (the New station) – KOKTOBE (the New station; the New Interchange node with the Proposed Radial Lane) – GORNYI GIGANT (the New station; the New Interchange node with the Proposed Radial Lane) – TRAMPLIN (the New station; the New Interchange node with the Proposed Radial Lane) – BAGANASHIL (the New station) – KAZAKHFILM (the New station; the New Interchange node with the Proposed Radial Lane) – NAVOI KOSHESI (the New station) – ORBITA (the New station; the New Interchange node with the Planned Radial lane) – TAUGUL' (the New station; the New Interchange node with the Proposed Radial Lane) – SARYARKA (the New station; the New Interchange node with the Planned Radial Lane) – ZHUBANOV KOSHESI (the New station) – AKSAI (the New station; the New Interchange node with the Proposed Radial Lane) – AKBULAK (the New station; the New Interchange node with the Proposed Radial Lane) – AIGERIM (the New station) – SHANYRAK (the New station; the New Interchange node with the Proposed Radial Lane) – DARKHAN (the New station) – UZHET (the New station; the New Interchange node with the Proposed Radial Lane) – TSCHERIOMUSHKI (the New station; the New Interchange node with the Planned Radial Lane) – ZHANSUGUROV KOSHESI (the New station) – WOKZAL ALMATY-1 (the New station; the New Interchange node with the Planned Radial Lane) – KRASNOGVARDEISKY TRAKT (the New station; the New Interchange node with the Proposed Radial Lane) – ZHULDUZ (the New station).

The Second Stage of the Development.

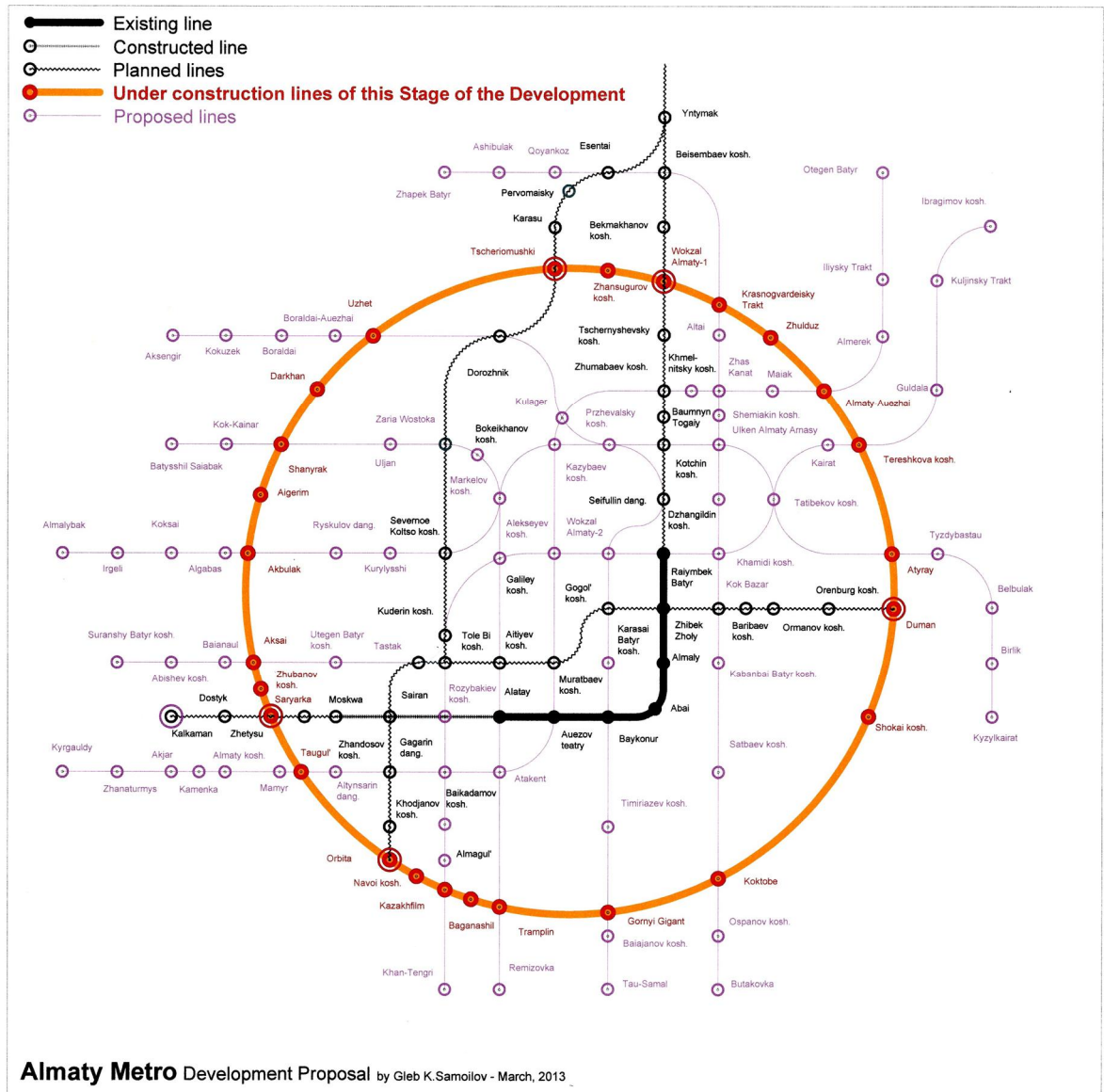
The Second Stage of the Ring-Radial scheme development (Figure 14) - the Radial lanes construction (53 new stations, 15 operated interchange nodes). New thirteen lanes are arranged on the outer side of the Ring.

Lines under construction for this Development Stage:

The 1st outer portion of lanes (4 new stations, 1 operated interchange node): SURANSKY BATYR KOSHESI (the New station) – ABISHEV KOSHESI (the New station) – BAIANAUL (the New station) – AKSAI (the New station; the operated Interchange node with the Ring Lane).

THE ALMATY METRO DEVELOPED NETWORK

THE FIRST STAGE OF THE RING-RADIAL SCHEME DEVELOPMENT

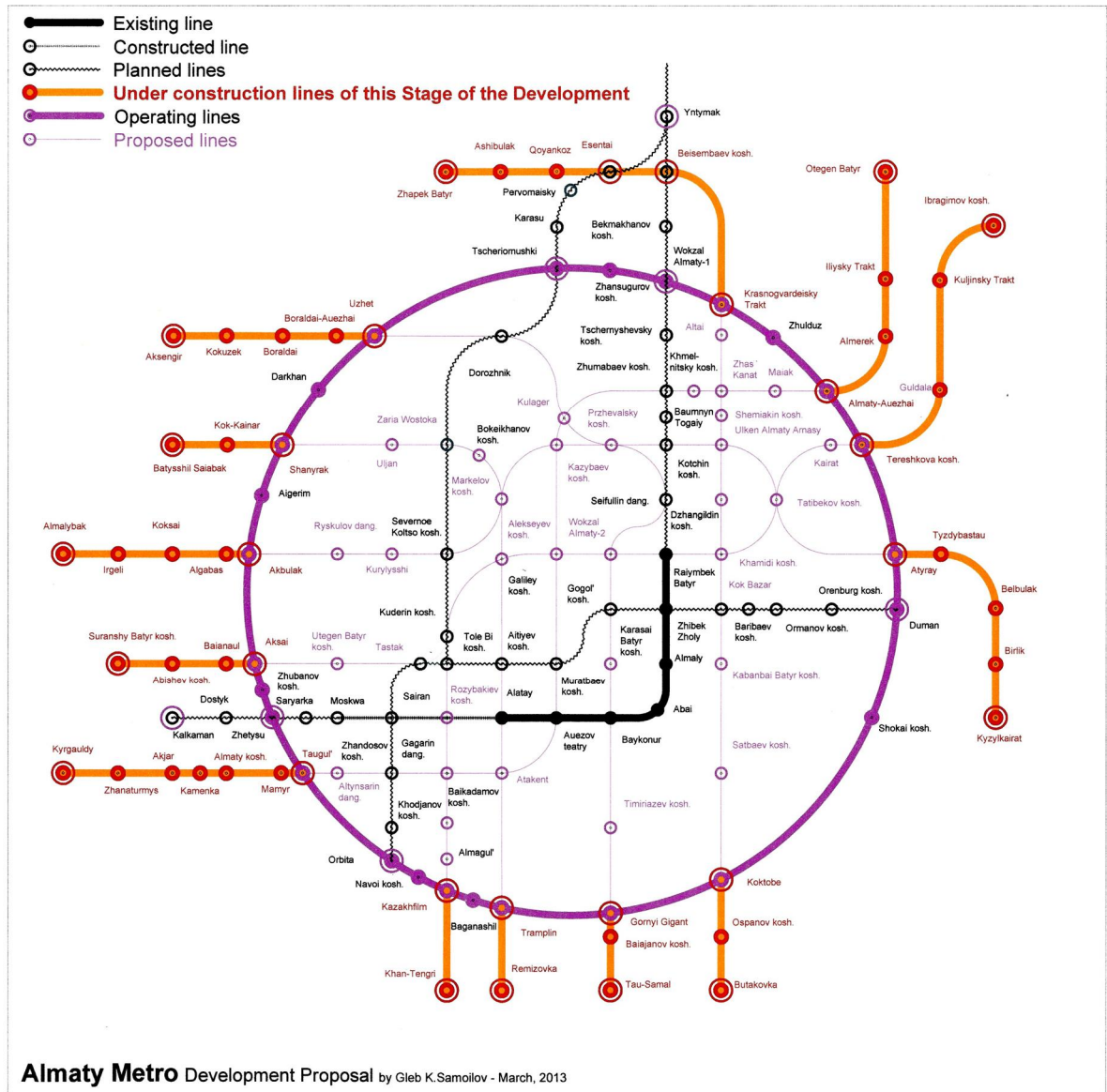


Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov "Gleconsam" (March, 2013)

Figure 13.
The First Stage of the Almaty Metro Development.

THE ALMATY METRO DEVELOPED NETWORK THE SECOND STAGE OF THE RING-RADIAL SCHEME DEVELOPMENT



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K.Samoilov "Gleconsam" (March, 2013)

Figure 14.
The Second Stage of the Almaty Metro Development.

The 2nd outer portion of lanes (4 new stations, 1 operated interchange node): TERESHKOVA KOSHESI (the New station; the operated Interchange node with the Ring Lane) – GULDALA (the New station) – KULJINSKY TRAKT (the New station) – IBRAGIMOV KOSHESI (the New station).

The 3rd outer portion of lanes (7 new stations, 1 operated interchange node): KYRGAULDY (the New station) – ZHANATURMYS (the New station) – AKJAR (the New station) – KAMENKA (the New station) – ALMATY KOSHESI (the New station) – MAMYR (the New station) – TAUGUL' (the New station; the operated Interchange node with the Ring Lane)

The 4th outer portion of lanes (4 new stations, 1 operated interchange node): ALMATY AUEZHAI (the New station; the operated Interchange node with the Ring Lane) – ALMEREK (the New station) – ILIYSKY TRAKT (the New station) – OTEGEN BATYR (the New station).

The 5th outer portion of lanes (5 new stations, 1 operated interchange node): ALMALYBAK (the New station) – IRGELI (the New station) – KOKSAI (the New station) – ALGABAS (the New station) – AKBULAK (the New station; the operated Interchange node with the Ring Lane).

The 6th outer portion of lanes (5 new stations, 1 operated interchange node): ATYRAY (the New station; the operated Interchange node with the Ring Lane) – TYZDYBASTAU (the New station) – BELBULAK (the New station) – BIRLIK (the New station) – KYZYLKAIRAT (the New station).

The 7th outer portion of lanes (3 new stations, 1 operated interchange node): BATYSSHIL SAIABAK (the New station) – KOK-KAINAR (the New station) – SHANYRAK (the New station; the operated Interchange node with the Ring Lane).

The 8th outer portion of lanes (2 new stations, 1 operated interchange node): TRAMPLIN (the New station; the operated Interchange node with the Ring Lane) – REMIZOVKA (the New station).

The 9th outer portion of lanes (5 new stations, 1 operated interchange node): AKSENGIR (the New station) – KOKUZEK (the New station) – BORALDAI (the New station) – BORALDAI-AUEZHAI (the New station) – UZHET (the New station; the operated Interchange node with the Ring Lane).

The 10th outer portion of lanes (3 new stations, 1 operated interchange node): GORNY GIGANT (the New station; the operated Interchange node with the Ring Lane) – BAIJANOV KOSHESI (the New station) – TAU-SAMAL (the New station).

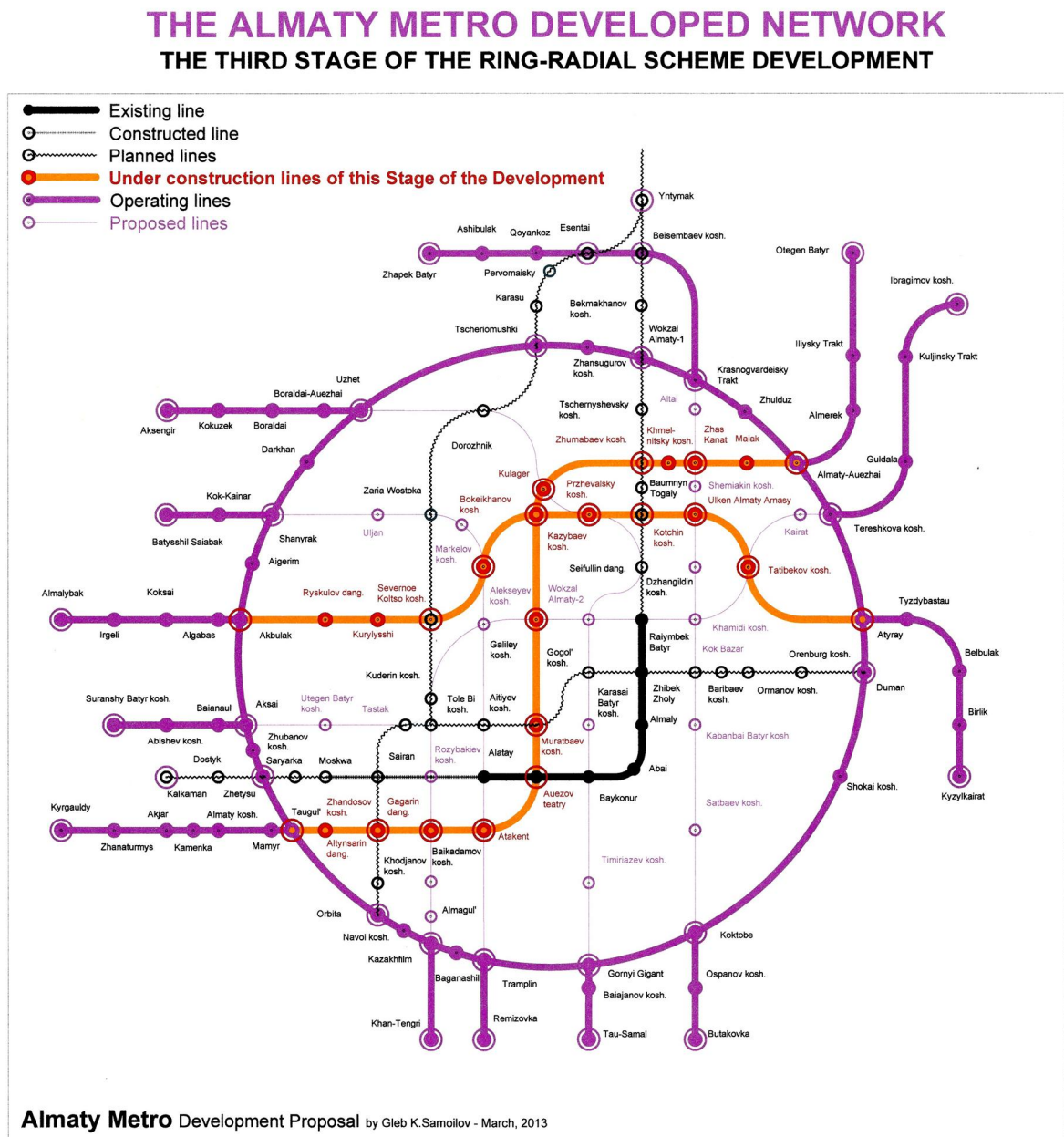
The 11th outer portion of lanes (6 new stations, 3 operated interchange nodes): ZHAPEK BATYR (the New station) – ASHIBULAK (the New station) – QOYANKOZ (the New station) – ESENTAI (the New station; the operated Interchange node with the Radial Lane) – BEISEMBAEV KOSHESI (the New station; the operated Interchange node with the Radial Lane) – KRASNOGVARDEISKY TRAKT (the New station; the operated Interchange node with the Ring Lane).

The 12th outer portion of lanes (3 new stations, 1 operated interchange node): KOKTOBE (the New station; the operated Interchange node with the Ring Lane) – OSPANOV KOSHESI (the New station) – BUTAKOVKA (the New station).

The 13th outer portion of lanes (2 new stations, 1 operated interchange node): KAZAKHFILM (the New station; the Operated Interchange node with the Ring Lane) – KHAN-TENGRI (the New station).

The Third Stage of the Development.

The Third Stage of the Ring-Radial scheme development (Figure 15) - the Radial lines construction (21 new stations, 4 operated stations, 6 operated interchange nodes, 10 new interchange nodes). New two (the 1st, the 2nd) lines are arranged on the inner side of the Ring.



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K. Samoilov "Gleconsam" (March, 2013)

Figure 15.
The Third Stage of the Almaty Metro Development.

Lines under construction for this Development Stage:

The 1st inner portion of lines (13 new stations, 2 operated stations, 4 operated interchange nodes, 6 new interchange nodes): TAUGUL' (the Operated station, the operated Interchange node with the Ring Line) – ALTYN SARIN DANGYLY (the New station) – ZHANDOSOV KOSHESI (the New station, the operated Interchange node with the Radial Line) – GAGARIN DANGYLY (the New station, the new Interchange node with the Radial Line) – ATAKENT (the New station, the new Interchange node with the Radial Line) – AUEZOV TEATRY (the New station, the operated Interchange node with the Radial Line) – MURATBAEV KOSHESI (the New station, the operated Interchange node with the Radial Line) – ALEKSEEV KOSHESI (the New station, the new Interchange node with the Radial Line) – KAZYBAEV KOSHESI (the New station, the new Interchange node with the Radial Line) – KULAGER (the New station, the new Interchange node with the Radial Line) – ZHUMABAEV KOSHESI (the New station, the operated Interchange node with the Radial Line) – KHMELKNITSKY KOSHESI (the New station) – ZHAS KANAT (the New station, the new Interchange node with the Radial Line) – MAIAK (the New station) – ALMATY AUEZHAI (the Operated station, the operated Interchange node with the Ring Line).

The 2nd inner portion of lines (9 new stations, 2 operated stations, 2 operated interchange nodes, 5 new interchange nodes): AKBULAK (the Operated station, the operated Interchange node with the Ring Line) – RYSKULOV DANGYLY (the New station) – KURYLYSSHI (the New station) – SEVERNOE KOLTSO KOSHESI (the New station, the operated Interchange node with the Radial Line) – BOKEIKHANOV KOSHESI (the New station, the new Interchange node with the Radial Line) – KAZYBAEV KOSHESI (the New station, the new Interchange node with the Radial Line) – PRZHEVALSKY KOSHESI (the New station, the new Interchange node with the Radial Line) – KOTCHIN KOSHESI (the New station, the operated Interchange node with the Radial Line) – ULKEN ALMATY ARNASY (the New station, the new Interchange node with the Radial Line) – TATIBEKOV KOSHESI (the New station, the new Interchange node with the Radial Line) – ATYRAY (the Operated station, the operated Interchange node with the Ring Line).

The Fourth Stage of the Development.

The Fourth Stage of the Ring-Radial scheme development (Figure 16) - the Radial lines construction (37 new stations, 6 operated stations, 13 operated interchange nodes, 3 new interchange nodes). New three (the 3rd, the 4th, 5th) lines are arranged on the inner side of the Ring.

Lines under construction for this Development Stage:

The 3rd inner portion of lines (10 new stations, 2 operated stations, 3 new interchange nodes, 6 operated interchange nodes): AKSAI (the Operated station, the operated Interchange node with the Ring Line) – UTEGEN BATYR KOSHESI (the New station) – TASTAK (the New station, the operated Interchange node with the Radial Line) – KUDERIN KOSHESI (the New station, the operated Interchange node with the Radial Line) – GALILEY KOSHESI (the New station, the new Interchange node with the Radial Line) – ALEKSEYEV KOSHESI (the New station, the operated Interchange node with the Radial Line) – WOKZAL ALMATY-2 (the New station, the new Interchange node with the Radial Line) – RAIYMBEK BATYR (the New station, the operated Interchange node with the Radial Line) – KHAMIDI KOSHESI (the New station, the new Interchange node with the Radial Line) – TATIBEKOV KOSHESI (the New station, the operated Interchange node with the Radial Line) – KAIRAT (the New station) – TERESHKOVA KOSHESI (the Operated station, the operated Interchange node with the Ring Line).

THE ALMATY METRO DEVELOPED NETWORK

THE FOURTH STAGE OF THE RING-RADIAL SCHEME DEVELOPMENT

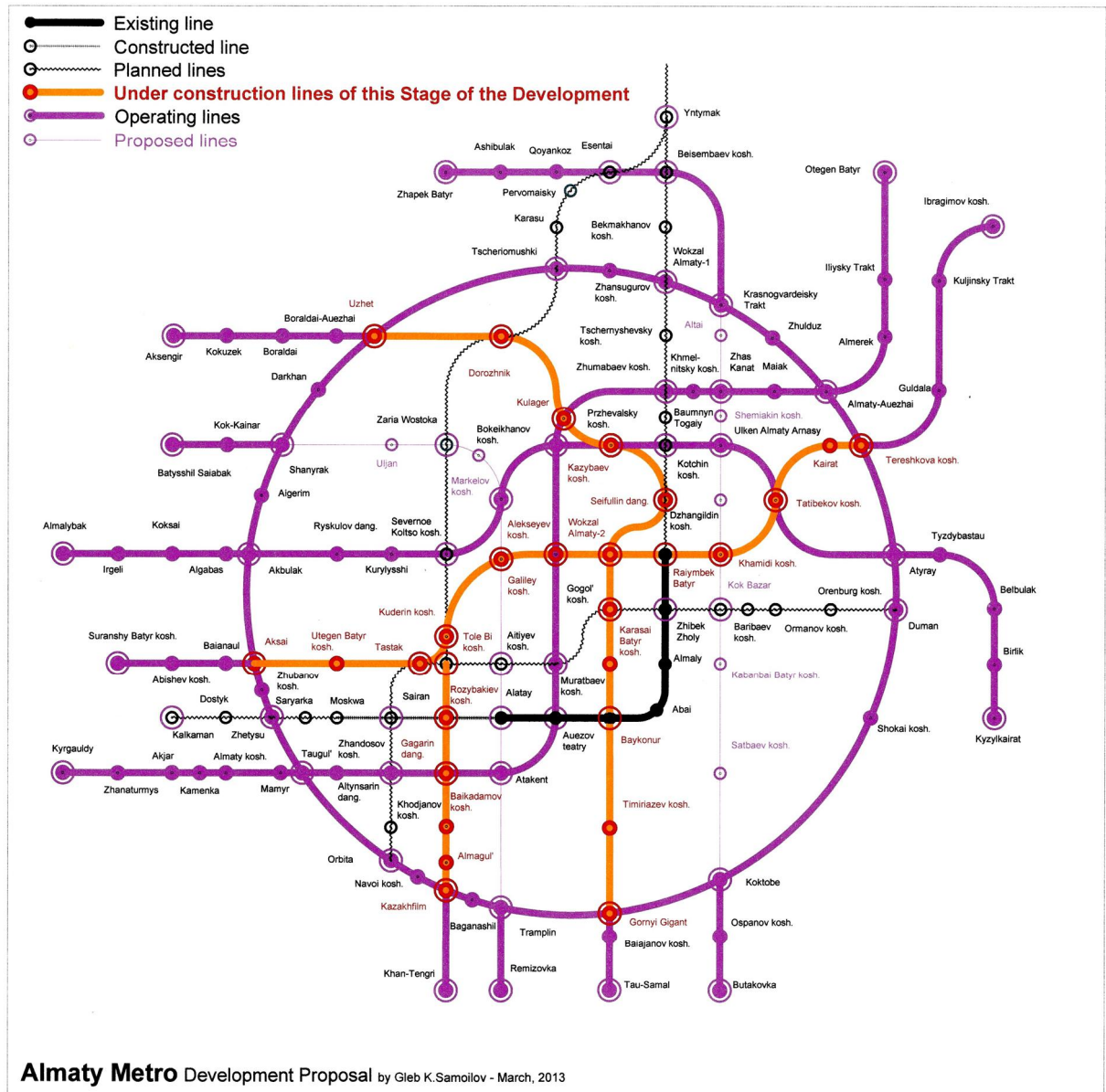
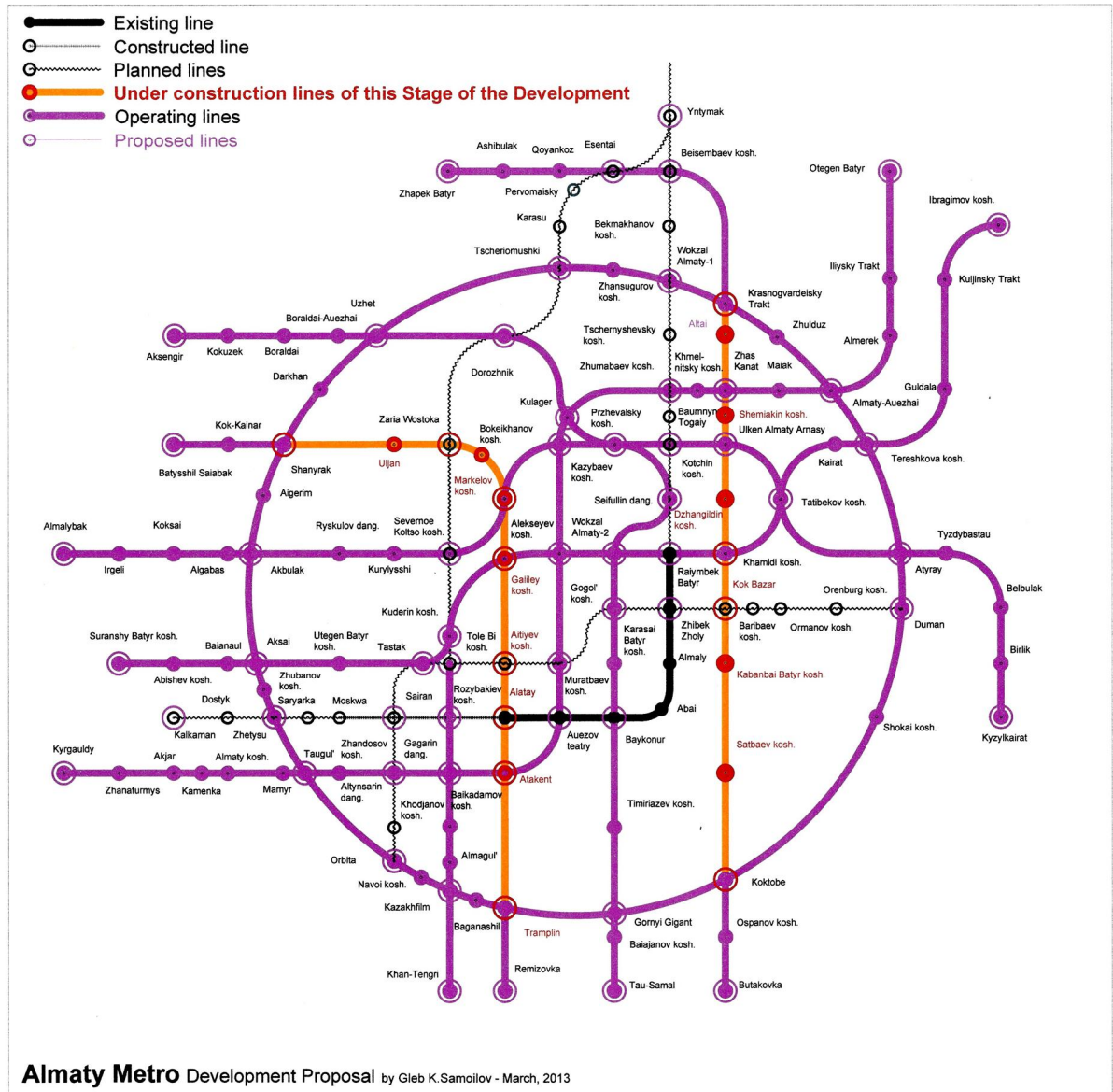


Figure 16.
The Fourth Stage of the Almaty Metro Development.

THE ALMATY METRO DEVELOPED NETWORK

THE FIFTH STAGE OF THE RING-RADIAL SCHEME DEVELOPMENT



Images source:

Drawing of the Almaty Metro Development Proposals Author - Gleb K. Samoilov "Gleconsam" (March, 2013)

Figure 17.
The Fifth Stage of the Almaty Metro Development.

The 4th inner portion of lines (9 new stations, 2 operated station, 1 new interchange node, 8 operated interchange nodes): UZHET (the Operated station, the operated Interchange node with the Ring Line) – DOROZHNIK (the New station, the operated Interchange node with the Radial Line) – KULAGER (the New station, the operated Interchange node with the Radial Line) – PRZHEVALSKY KOSHESI (the New station, the operated Interchange node with the Radial Line) – SEIFULLIN DANGYLY (the New station, the operated Interchange node with the Radial Line) – WOKZAL ALMATY-2 (the New station, the new Interchange node with the Radial Line) – GOGOL' KOSHESI (the New station, the operated Interchange node with the Radial Line) – KARASAI BATYR KOSHESI (the New station) – BAYKONUR (the New station, the operated Interchange node with the Radial Line) – TIMIRIAZEV KOSHESI (the New station) – GORNY GIGANT (the Operated station, the Interchange node with the Ring Line).

The 5th inner portion of lines (4 new stations, 2 operated stations, 4 operated interchange nodes): TOLE BI KOSHESI (the Operated station, the operated Interchange node with the Radial Line) – ROZYBAKIEV KOSHESI (the New station, the operated Interchange node with the Radial Line) – GAGARIN DANGYLY (the New station, the operated Interchange node with the Radial Line) BAIKADAMOV KOSHESI (the New station) – ALMAGUL' (the New station) – KAZAKHFILM (the Operated station, the operated Interchange node with the Ring Line).

The Fifth Stage of the Development.

The Fifth Stage of the Ring-Radial scheme development (Figure 17) - the Radial lines construction (17 new stations, 4 operated stations, 14 operated interchange nodes). New two (the 6th, the 7th) lines are arranged on the inner side of the Ring.

Lines under construction for this Development Stage:

The 6th inner portion of lines (8 new stations, 2 operated stations, 8 operated interchange nodes): SHANYRAK (the Operated station, the operated Interchange node with the Ring Line) – ULJAN (the New station) – ZARIA WOSTOKA (the New station, the operated Interchange node with the Radial Line) – MARKELOV KOSHESI (the New station) – BOKEIKHANOV KOSHESI (the New station, the operated Interchange node with the Radial Line) – GALILEY KOSHESI (the New station, the operated Interchange node with the Radial Line) – AITIYEV KOSHESI (the New station, the operated Interchange node with the Radial Line) – ALATAY (the New station, the operated Interchange node with the Radial Line) – ATAKENT (the New station, the operated Interchange node with the Radial Line) – TRAMPLIN (the Operated station, the operated Interchange node with the Ring Line).

The 7th inner portion of lines (9 new stations, 2 operated stations, 6 operated interchange nodes): KRASNOGVARDEISKY TRAKT (the Operated station, the operated Interchange node with the Ring Line) – ALTAI (the New station) – ZHAS KANAT (the New station, the operated Interchange node with the Radial Line) – SHEMIKIN KOSHESI (the New station) – ULKEN ALMATY ARNASY (the New station, the operated Interchange node with the Radial Line) – DZHANGILDIN KOSHESI (the New station) – KHAMIDI KOSHESI (the New station, the operated Interchange node with the Radial Line) – KOK BAZAR (the New station, the operated Interchange node with the Radial Line) – KABANBAI BATYR KOSHESI (the New station) – SATBAEV KOSHESI (the New station) – KOKTOBE (the Operated station, the operated Interchange node with the Ring Line).

The result of consistent implementation of the Project is the Developed Network of the Almaty Metro. It allows us to solve the problem of convenient transportation access to the entire Almaty conurbation.

THE CONCLUSION

The existing system of Almaty Metro should develop. Now 850 000 inhabitants of the Almaty and 320 thousand inhabitants of communities in the vicinity of the City, who work, rest, study, shop, use the airport, bus and railway stations do not have easy access to the Metro.

I propose a phased development of the network of the Almaty Metro in the form of a complex of new lines, which are combined with the current ones. The implementation of this scheme will in the foreseeable future even more link bus and trolleybus routes with subway stations. In doing so, bus and trolleybus routes will be much shorter, connecting some parts of the city with one or two nearest metro stations. The resulting system is a kind of "short route" will greatly enhance convenience for passengers, creating a subway integrated public transport network.

Well-functioning system of integrated public transport will significantly reduce the number of cars on streets of the city by reducing the number of buses, and by providing a convenient alternative to personal vehicles.

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